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CONTROL OF WATER HYACINTH IN THE ST. JOHNS RIVER, PUTNAM COUNTY--ETC(U)
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Method of Treatment

The use of 2,4-D

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The aquatic plant control plan as proposed calls for the control and progressive eradication of the water hyacinth and other water weeds from the St. John's River, using the herbicide 2,4-D.

Over the years, the water hyacinth has clogged the St. Johns River to the point that it is a hazard to navigation and recreational activities. Mechanical harvesting proved to be largely ineffective, and biological controls are not adequately developed. Therefore, the use of herbicides was the logical control

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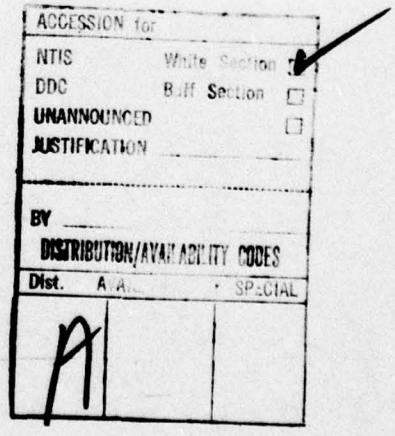
method. The herbicide 2,4-D has proved to be a very effective control agent. However, it had been prohibited from use in any free-flowing waters. The Department of the Army, Office of the Chief of Engineers, submitted a petition to the EPA requesting that 2,4-D be approved for use in the St. John's River. After a series of studies indicated that the herbicide 2,4-D did not have adverse environmental effects, the EPA approved a registration for this use.



CONTROL OF WATER HYACINTH IN THE ST. JOHNS RIVER

PUTNAM COUNTY, FLORIDA

Introduction

The Corps of Engineers Aquatic Plant Control Program, initiated in 1899, was accelerated and expanded in 1958 and in 1965, to achieve progressive control and eradication of primary weed infestations of greatest economic importance in the eight South Atlantic and Gulf Coastal States from North Carolina to Texas. Water hyacinth, alligatorweed and Eurasian watermilfoil infestations were the primary problem aquatic weeds. Currently, mechanical, chemical and biological methods of control are being used. The benefit-to-cost ratio considerably exceeds the 5 to 1 estimate on the basis of which the program was authorized, and sustains the 14 to 1 ratio determined for the preceding pilot project.

History of Aquatic Plant Infestation

The first authentic account of the presence of water hyacinth in this country was at the Cotton Exposition in New Orleans, Louisiana, in 1884. Alligatorweed was noted in the United States at about that time, but it did not become a real problem for many years. These two plants have spread to many waterways with the greatest infestation in the States of Florida and Louisiana. In 1898, Congress, recognizing the potential hazard to navigation within the waterways, requested that the Chief of Engineers investigate and report on the obstruction

of the navigable waters of Florida, Louisiana, and other South Atlantic and Gulf States by the waterhyacinth. That report (H. Doc. Nol 91, 55th Cong., 3d Session) and the Annual Report of the Chief of Engineers, 1899, pp. 1613-1623, resulted in authorization of work by the Corps of Engineers "for the construction and operation of suitable vessels, and for the use of log booms as adjuncts to the operation of the vessels, for the removal of water hyacinth in the navigable waters of the States of Florida and Louisiana" by the Rivers and Harbors Act of March 3, 1899.

By 1900, practically all of the main bayous in Louisiana were badly infested with waterhyacinth and many of the streams were reported to be completely blocked. In some instances the lower reaches of many of the streams were unsafe for navigation. In Florida, waterhyacinth had taken over the St. Johns River at Palatka to such extent that steamboats and other craft were unable to reach the docks or pass through the navigation openings of the bridges. Since then it has spread to many of the remaining waterways in Georgia, Alabama, Mississippi, and Texas and particularly in peninsular Florida and water courses in Louisiana.

Following the advent of a new herbicide, 2,4-D, Congress requested the Corps of Engineers in 1945 to determine whether any expansion of the scope of operations or methods of control were advisable at that time, to determine the nature and extent of the various public benefits that would accrue

from extermination and removal, and to determine the amount of local benefits. That report resulted in the establishment of a comprehensive program to provide for control and progressive eradication of obnoxious aquatic plants in the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and Texas, designated as the "Expanded Project for Aquatic Plant Control."

Control operations of the project were extended to a nation-wide program in 1965 to consider the combined interest of navigation, flood control, drainagfe, agriculture, fish and wildlife conservation, public health, water quality control, recreation, and related purposes. Most of the control operations are still limited to the Gulf States, Florida and Louisiana specifically, since these states have developed active programs and the need is greatest in these areas (1).

Corps of Engineers Project Authority

The expanded project for control of different species of obnoxious aquatic plants was initiated 1 July 1967. Section 302 of the Rivers and Harbors Act of 1965 (P. L. 89-298; 33 U.S.C. Section 610) authorized a continuing program based upon the information presented to the 89th Congress on the pilot project as contained in House Document 251 (1), and testimony presented by the Chief of Engineers containing data from the U. S. Department of Agriculture, U. S. Public Health Service, and the U. S. Fish and Wildlife Service to the Subcommittee

on Flood Control-Rivers and Harbors of the Committee on Public Works, United States Senate in June of 1965. Provisions for research and planning for the program were included which are borne fully by the Federal Government, and provisions for control operations were made by which local interests must agree to hold and save the United States free of claims that may occur from control operations and participate to the extent of 30 per cent of the cost of such operations.

Effects of Aquatic Plant Infestation

The most recent surveys indicate the presence of several types of aquatic infestations in Florida, including water hyacinth, alligatorweed, Eurasion watermilfoil, hydrilla and a number of other surface, bank and submersed weeds. The long growing season and other environmental elements are particularly favorable for the growth and propagation of aquatic plants in this state.

Water hyacinth and alligatorweed often grow sufficiently dense to block or impede boat traffic, damage propellers and marine cooling systems, and increase navigation hazards in the vicinity of bridges, docks, piers, etc. The dense mats formed by alligatorweed are particularly difficult for boats to penetrate. The dense above water foliage is supported on thick underwater mats composed of the stems and laterals of the plants. Without control of these aquatic plants, commercial navigation would cease to exist after a few years in many streams.

Aquatic plants seriously congest or completely blanket slowly flowing natural streams and drainage canals, thus reducing their discharge capacities. Small channels and shallow waterways often become congested, and the resultant retarded runoff increases stages, extent, duration, and frequency of flooding. Effective aquatic plant control will relieve these flood problems.

In areas where irrigation water is pumped from surface supplies, aquatic plants clog pump intakes and reduce flow to the pumps. Normally, land being irrigated is fertile and low. Water in these ditches and canals flows at low velocities and frequently contains fertilizer leached from adjacent croplands. Under these conditions, aquatic plants grow rapidly and seriously retard water flow.

In many areas where masses of floating plants cover smaller waterways, and ponds, the infestations have rendered the areas unusable for fish habitat by exhausting the dissolved oxygen in the water, by occluding needed sunlight essential for basic food production, and by rendering shallow water spawning areas unusable. In regards to wildlife, drifting mats of weeds destroy beds of submerged plants, defoliate floating-leafed aquatics and overwhelm marginal food plants which may be the desirable foods for waterfowl.

Aquatic plant infestations frequently interfere with and practically eliminate recreational use of water areas. In addition to preventing access to and the use of waters for

hunting and fishing, they preclude boating, swimming, skiing, and other water-orientated activities. Mosquito production almost invariably occurs in the aquatic plants of waters adjacent to recreation areas and furnishes a source of nuisance to campers and other recreationists.

The production of disease-carrying and pest mosquitos is aided by mats of water hyacinth and alligatorweed. Infestation of aquatic plants in the vicinity of population centers occasionally requires mosquito control as a health measure. The leaves of water hyacinth plants trap and hold water which, in the dense mats, provide excellent mosquito breeding areas.

Where surface waters are used as a source of water supply, heavy growths of aquatic plants are a problem. Studies in Florida have shown the rate of loss of water in water hyacinth infested areas is 3.7 times greater than in areas without hyacinths. Transpiration, when added to evaporation, consumes the water intended for other beneficial uses (1, 2, 3, 4, 5).

Control and Eradication

As early as 1898 tests were conducted to find methods by which the water hyacinth could be effectively eradicated. These tests, and subsequent tests in 1906, utilized a wide variety of chemical sprays. None of these chemical eradicants were found to be both economically and ecologically feasible.

During the early phases of the Corps of Engineers aquatic weed eradication program, many different mechanical devices were designed to cope with the dense infestations of water hyacinths. Early control operations were based almost exclusively on mechanical procedures such as gang-saw boats to open up paths for navigation, physical removal by derrick and grapple, the use of hand labor to cut blocks of matted water hyacinths with six-foot timber saws, and the use of special barges equipped with conveyor belts for picking up the plants and depositing them on the shore as well as crusher boats which crushed the plants into a pulp and then deposited the pulp directly into the water.

While in some cases mechanical methods temporarily open waterways or lakes, they also tend to spread aquatic plants by fragmentation. This, coupled with the presently prohibitive cost of widespread mechanical control measures, has led to current control measures involving the use of chemical and biological agents.

Corps of Engineers spraying is done by boat and aircraft with an amine salt of 2,4-dichlorophenoxyacetic acid. This herbicide is an organic chemical belonging to a group of substances known as plant hormones or growth regulators. It has been widely recommended for aquatic plant control and continues to be the most widely used herbicide. It is non-toxic to humans and animals when ingested in concentrations likely to follow its application as a herbicide. Generally,

depending upon size and depth of the body of water and whether it is freely flowing or sluggish, there are no harmful effects from control operations on water supplies. In instances where the supply source is very heavily infested and where there is little discharge, special precautions are taken by treating only portions of the growth at one time. No adverse effects on water supplies have been reported since widespread use of 2,4-D was started by the Corps and State and local agencies in other states for hyacinth control. The spray material contains 4 pounds per gallon of active acid equivalent and is applied at the rate of 2 to 4 pounds of active acid equivalent to an acre of vegetation. The herbicide 2,4-D is toxic to many desirable broadleaf plants. However, its application is controlled at all times to prevent the drifting of spray onto cultivated lands, ornamentals, or desirable aquatics. Aerial spraying is performed only when winds are minimal (3-5 mph). Spraying by boat or land based equipment is not performed when wind velocities exceed 10 mph (4, 5, 6).

Specific Exemption

The chemical treatment of water hyacinth in the St. Johns River Florida was declared illegal by the Environmental Protection Agency on December 4, 1973.

On December 23, 1973, an application for a specific exemption from the requirements of the Federal Insecticide,

Fungicide, and Rodenticide Act (FIFRA), as amended (86 Stat. 973), was made to the Environmental Protection Agency (EPA) from the Department of the Army, Office of the Chief of Engineers, Director of Civil Works, Washington, D.C. 20314, pursuant to para 166.2(a) of the regulations (40 CFR Part 166) governing exemption of Federal and State Agencies for use of pesticides under emergency conditions. The regulations were published in the Federal Register on December 3, 1973 (38 FR 33303).

The U.S. Corps of engineers, Department of the Army (hereafter referred to as the "Applicant"), has requested the use of the chemical 2,4-D (dimethylamine salt of 2,4 dichlorophenoxy acetic acid) for control and progressive eradication of waterhyacinths from the navigable waters, tributary streams, connecting channels and other allied waters of the St. Johns River, Florida. All interested persons were referred to the application on file with the Registration Division (HM-567), Office of Pesticide Programs, Room 347, East Tower, Environmental Protection Agency, Washington, D.C. 20460, for a statement of the representations contained therein which are summarized below.

(1) Nature, scope and frequency of the emergency. On December 4, 1973, the Deputy Assistant Administrator for Pesticide Programs, EPA, sent a letter directing the Corps of Engineers to stop using products containing the chamical 2,4-D in the St. Johns Rivers, since that chemical is not registered for use in flowing/moving waters. The

Applicant states that the rapid and extensive growth of waterhyacinths in this river is a hazard to navigation and recreation activities. According to the Applicant, there is no known method of control as effective as this chemical.

(2) Description of the pest (Waterhyacinth). The Applicant states that the plants are floating and oftenime rooted in mud, with slender, perennial rootstocks and rosettes of stalked-inflated leaves and fibrous, branching dark roots. Petioles oftentime are inflated or bladderlike. The plants reproduce largely by vegetative means and are connected by stolons. The waterhyacinth shows considerable variation in size, the plants ranging from a few centimeters to nearly a meter in height. Plants infrequently set seed within a large population. The seeds may sink to the bottom and then remain dormant until periods of water stress, i.c., droughts. Upon reflooding, the seeds may germinate and renew the populations in spite of the conspicuous absence of vegetative material.

(3) Pesticide registration. The Applicant states that the use of the chemical 2,4-D would permit them to conduct a program of Aquatic Plant Control by the use of 2,4-D in moving water. However, the chemical 2,4-D is registered for control of aquatic weeds in still water, e.g., lakes, ponds, etc., and a very limited use in the Northwest in irrigatrion ditches with an established residue tolerance in water of 0.1 part per million (ppm).

(4) Pesticides to be used. The Applicant states that the chemical 2,4-D has been found to be a very effective and feasible measure of control. He also states that other herbicides such as sodium arsenite or amitrole are effective but are undesirable from an environmental point of view. It should be noted that sodium arsenite and amitrole are not registered for such use; consequently, before the Corps of Engineers could use these pesticides, it would be required to either apply for registration or request an exemption under section 18 of the FIFRA, as amended (40 CFR Part 166).

(5) Applicant's description of the eradication or control program. i. The chemical 2,4-D would be applied at a rate of two to four pounds per acre for control of waterhyacinths, applied directly to the floating mat. One application is normally sufficient to kill the plant. Follow-up applications as a spot treatment are normally necessary in a control program. For treatment of approximately 3,000 acres of waterhyacinths, approximately 12,000 pounds acid equivalent would be required.

ii. The chemical would be applied on floating mats of waterhyacinths in the St. Johns river. The program in this request for specific exemption covers only the area of the St. Johns River from Lake Harney to approximately Jacksonville.

iii. Chemical application would be made from air boats as a direct spray at 75-100 pounds pressure in 100-200 gallons of water per acre.

iv. Treatment would involve the spring-summer season, April through September.

v. The chemical would be applied by trained personnel of the Corps of Engineers or by contracts under the direct supervision of the Corps of Engineers. Engineer Regulation ER 1105-2-412, Planning and Engineer Regulation ER 1130-2-413, Operations, and a manual for the personnel training program are available from the Corps of Engineers upon request.

(6) Statement of economic benefits and losses anticipated with and without the exemption. The Applicant states that annual benefits in the interest of commercial navigation and recreation are estimated at $1,092,750.00 with a benefit-cost ratio of 3.0 to one.

(7) Analysis of possible adverse effects on man and the environment. The Final Environmental Impact Statement for the Hyacinth Control Program in Florida which includes the St. Johns River was filed with the Council for Environmental Quality on September 11, 1973.

Residual 2,4-D Levels

In response to conditions of the specific exemption, the U.S. Army Corps of Engineers conducted extensive studies to determine the residual levels of (2,4-dichlorophenoxy) acetic acid (2,4-D) in flowing water i.e. the St. Johns River, Florida. The levels of 2,4-D observed were well below established tolerance limits and there was no accumulation of 2,4-D in blue crabs (Callinectus sapidus Rathbun) in the treatment area (7).

The Corps of Engineers applied for a 2,4-D tolerance for aquatic application to the Department of Health, Education, and Welfare, Food and Drug Administration on August 7, 1970. The functions of the Food and Drug Administration were transferred to the Environmental Protection Agency under public Law 92-516.

A series of meetings were undertaken with the EPA and members of the Corps of Engineers in an effort to finalize the applications. Reports were submitted and reviewed, and new studies were initiated in coordination with EPA to obtain additional data (8-17).

On October 28, 1975, the Environmental Protection Agency (EPA) announced (40 FR 50124) that the Department of the Army, Office of the Chief of Engineers (DAEN-CWO-R), Washington, DC 20314, had submitted a petition (FAP6H5104) which proposed that 21 CFR 123.100 be amended by establishing a food additive regulation permitting the use of the herbicide and plant regulator 2,4-dichlorophenoxyacetic acid (2,4-D) in potable water with a tolerance of 0.1 part per million, residues that would result from the application of the methylamine salt of 2,4-D in water hyacinth control programs conducted by the Corps of Engineers or other Federal, State, or local public agencies in pounds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, rivers and streams that are quiescent or slow moving.

Tolerances were established for residues of the herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) as follows:

2 parts per million in the milled fractions (except flour) derived from barley, oats, rye, and wheat to be ingested as food or to be converted to food. Such residues may be present therein only as a result of application to the growing crop of the herbicides identified in 40 CFR 180.142.

0.1 part per million (negligible residue) in potable water. Such residues may be present therein only:

(a) as a result of the application of the dimethylamine salt of 2,4-D to irrigation ditch banks in the Western United States in programs of the Bureau of Reclamation; cooperating water user organizations; the Bureau of Sport Fisheries, U.S. Department of the Interior; Agricultural Research Service, U.S. Department of Agriculture; and the Corps of Engineers, U.S. Department of Defense.

(b) as a result of the application of the dimethylamine salt of 2,4-D for water hyacinth control in ponds, lakes, reservoirs, marches bayous, drainage ditches, canals, rivers and streams that are quiescent or slow moving in programs of the Corps of Engineers or other Federal, State, or local public agencies.

Summary and Conclusions

Plants destroyed by herbicides remain in the water and, in decomposing, deplete the oxygen supply and release stored nutrients for support of new plant growth. Oxygen depletion

temporarily subjects fresh water species to physiological stress; however, by treating the lake or body of water in sections at different times, the motile species are able to move to areas of more favorable conditions. The same low oxygen condition would be present if a large mat of vegetation were to remain untreated, as some plants would be continually dying and depleting the oxygen while the heavy mat would prevent reaeration at the surface. The dying vegetation from chemical treatment will cause a temporary noxious condition. However, once the bulk of the vegetation has been removed, the following maintenance treatments will have little effect on water oxygen levels.

It is found that continued use of 2,4-D will serve the public interest, and far outweigh the probable public detriment in discontinuing its use. There have been no observable long-term adverse effects on fish or waterfowl as a consequence of using 2,4-D as an aquatic weed control agent. This chemical is used not only by the Corps of Engineers but by the Game and Fresh Water Fish Commission of the State of Florida, by the Central and Southern Florida Flood Control District, and by numerous counties.

Extensive research and at least 20 years' field operations experience in Florida have shown that chemical control through the use of 2 to 4 kg acid equivalent per ha of 2,4-D (2,4-dichlorophenoxyacetic acid) is the most effective and economical method of control of water hyacinth currently

available to the Corps of Engineers. Conversely, if water hyacinths are allowed to grow without control the damaging effects on the entire public welfare would be very great. Depending on climatological conditions the fresh water areas of the State would, within a relatively short period, become packed with hyacinths. The oxygen content of the water in such areas would be reduced to a level which would not support fish. Operators of fish camps would not be able to launch boats nor would recreational boaters be able to take advantage of the water areas. Commercial navigation as well as pleasure navigation would be materially impeded. The conveyance capacity of flood control canals would be sharply reduced and evapotranspiration of water would be materially increased. Public health would be affected because of increased mosquito breeding and snake infestations.

The St. Johns River in Florida is an extensive slow moving river that originates in a marsh area near Vero Beach Florida and flows northward approximately 502 km through a series of lakes to Jacksonville Florida.

The Jacksonville District of the U.S. Army Corps of Engineers along with state and local agencies conducts water-hyacinth control operations throughout the St. Johns River Basin, using a chemical spray treatment with the dimethylamine salt of 2,4-D.

The results of a series of studies indicated that the herbicide 2,4-D did not have adverse environmental effects

and a registration for this use was approved by the Environmental Protection Agency.

References

1. U.S. Department of the Army, Expanded project for aquatic plant control. House document 251, 89th Congress Washington, D. C. 147 pp, 1965.

2. Walker, C. R., Toxicological effects of herbicides on fish environment. Water and Sewage Works. 3:113-116, 1969.

3. Walker, C. R., Problems in clearance and registration of herbicide for aquatic areas. Hyacinth contr. J. 9:5-17, 1971.

4. Gangstad, E. O., Herbicidal control of aquatic plants. Journ of Sanitary Engineering Division, ASCE, 98:397-406, 1972.

5. Holm, L. F., Weldon, L. W., and Blackburn, R. D., Aquatic Weeds. Science 166:699-709, 1969.

6. Schultz, D. P. and Gangstad, E. O., Dissipation of residues of 2,4-D in water, hydrosoil and fish. Aquatic Plant Mgmt. J. 14:43-45, 1976.

7. Joyce, J. C. and Sikka, H. C., Residual 2,4-D levels in the St. Johns River, Florida. Aquatic Plant Mgmt. J. 15:76-82, 1977.

8. Aly, O. M. and Faust, S. D., Studies on the fate of 2,4-D and ester derivatives in natural surface water. J. Agr. Chem. 12:541-3, 1964.

9. Audus, L. J. (Ed) The Physiology and Biochemistry of Herbicides, Academic Press, New York, London. 550 pp., 1964.

10. Averitt, W. K. and Gangstad, E. O., Dissipation of 2-4,D residues in static water. J. Environ. Qual. 5:145-147, 1976.

11. Bell, G. R., On the photochemical degradation of 2,4-Dichlorophenoxyacetic Acid and the structurally related compounds in the presence and absence of riboflavin. Botanical Gazette 109. 314-323, 1956.

12. DeMarco, J., Symons, J. M., and robeck, G. G., Behavior of Synthetic organics in stratified impoundments. J. Amer. Water Works Assoc. 59:965, 1967.

13. Frank, P. A. and Comes, R. D., Herbicides in pond water and hydrosoil. Weeds 15:210-213, 1967.

14. Hemmett, R. B. and Faust, S. F., Biodegradation kinetics of 2,4-dichlorophonoxyacetic acid by microorganisms. Herbicide Reviews 29:191-207, 1969.

15. Okey, R. W. and Bogan, R. A., Apparent involvement of electronic mechanisms limiting the microbial metabolism of pesticides. J. Water Pollut. Control. Fed. 37:692, 1965.

16. Schwartz, H. J., Microbial degradation of pesticides. J. Water Pollut. Control Fed. 39:1701. 1967.

17. Sikka, H. C., Appleton, H. T. and Gangstad, E. O., Uptake and Metabolism of dimethylamine salt of 2,4-dichlorophenoxy acetic acid by fish. J. Agric. Food Chem. 25:1030-1033, 1977.